

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

EME4066 – OPERATIONS RESEARCH

(All sections / Groups)

10 MARCH 2016
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTION TO STUDENT

1. This question paper consists of 5 pages with 5 questions only.
2. Attempt **FOUR** of the **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. All necessary working **MUST** be shown.

Question 1

A manufacturer produces three models of bicycles. Times (in hours) required for assembling, painting, and packaging of each model are as follows: Assembling: 2 hours, 3 hours and 3 hour for Models A, B and C respectively; painting: 3 hours, 2 hours and 1 hour for Models A, B and C respectively; and packaging: 1 hour, 1 hour and 2 hours for Models A, B and C respectively.

The total time available for assembling, painting, and packaging is 3500 hours, 2500 hours and 2000 hours for Models A, B and C respectively. The profit per unit for each model is at \$40 for Model A; \$50 for Model B; and \$60 for Model C.

- a) Using simplex method of linear programming determine the number of each type of bicycle that should be produced to obtain a maximum profit.

[20 marks]

- b) Now the management wanted to know the cost per hour for assembling, painting and packaging works. Transform the above primal formulation into a duality formulation. No solution is required for your duality transformation.

[5 marks]

Question 2

Landu Automotive Parts Company is producing three (3) casted auto parts consisting of master cylinder, disc brake caliper, and brake shoe. All these products can be produced in four (4) work stations. Each work station can produce 200 units per day. The production schedule for master cylinders, disc brake calipers and brake shoes is 250 units per day for each auto part.

Work station #1 takes 4 minutes to produce each master cylinder, 5 minutes for each disc brake caliper, and 6 minutes for each brake shoe. Work station #2 takes 3 minutes to produce each master cylinder, 6 minutes for each disc brake caliper, and 5 minutes for each brake shoe. Work station #3 takes 7 minutes to produce each master cylinder, 5 minutes for each disc brake caliper, and 6 minutes for each brake shoe. Work station #4 takes 6 minutes to produce each master cylinder, 4 minutes for each disc brake caliper, and 3 minutes for each brake shoe.

- a) Using VAM method of transportation solution determine the production schedule distribution and compute the total time required.

[10 marks]

- b) Determine the optimal production schedule distribution and total time by using MODI method.

[15 marks]

Continued....

Question 3

Noil Group of Company is having a cash flow problem. The Group is now taking a critical decision to overcome the problem and plan to generate more income through the following actions:

- Expand the plant and produce more niche products for military purpose which has little competition;
- Improve production capacity and reduce costs;
- Offer for sale on one of its good subsidiaries for a quick cash to the company.

The amount of profit and sale price that could be generated will depend on the economic and foreign market conditions. The following payoff tabulation in Table 1 describes the situation.

Table 1: Projection of Future Prospects of Business

Decision	Sound Economic and Better Foreign Market Prospect	Declining Economic and Poor Foreign Market Prospect
Expand for new military products	\$1,200,000	\$700,000
Improve production line and reduce cost	\$1,100,000	\$800,000
Sell now for a quick cash	\$700,000	\$500,000

The Group has decided to use the following tools in making the decision. Determine the following criteria and justify your final decision.

- Maximax Criterion; [3 marks]
- Maximin Criterion; [3 marks]
- Minimax Regret Criterion; [5 marks]
- Hurwicz Criterion (0.3); [6 marks]
- Equal Likelihood Criterion. [6 marks]
- Justify the choice for the best decision among the above criteria. [2 marks]

Continued....

Question 4

- a) In a manufacturing plant all finished products are required to be stocked in into the finished goods warehouse. All finished products will be pushed in line to the gate of the finished goods warehouse. A checker will be waiting at the gate entrance and will do the checking on each consignment of finished products before allowing the consignment to pass through. The checker can maintain an average checking of 300 finished products per hour (at exponential distribution). Arrival of finished products (at Poisson distribution) arrives at an average of 280 finished products per hour. The production and warehouse managers wanted to know the efficiency of the stocking in of the finished products. As an industrial engineer you are required to provide that information through the following suggested criteria.
- i. Determine the average number of finished products awaiting in line to be stocked in. [3 marks]
 - ii. Determine the percentage of the time when the checker is busy. [3 marks]
 - iii. Determine the average time each finished product spends in the system. [3 marks]
 - iv. Determine the average time the finished products spend before reaching the gate. [3 marks]
 - v. Determine the probability that there are (i) more than 10 consignments finished product awaiting to be stocked in, (ii) more than 20 consignments finished products awaiting to be stocked in, and (iii) more than 30 consignments finished products awaiting to be stocked in. [6 marks]
- b) In one assembly company, before the finished products were sent to the finished good warehouse the products have to be inspected by a QA engineer. The number of finished good products will normally arrive at the inspection station at a rate of 200 per hour (Poisson distributed). The QA engineer can inspect on an average of 220 finished products per hour (Exponential distributed).
- i) Determine the average number of products awaiting at the inspection station. [2 marks]
 - ii) Determine the average time spent at the inspection station by each finished product. [2 marks]
 - iii) Determine the average waiting time before being inspected for each finished product. [3 marks]

Continued....

Question 5

UNN University is planning to buy new copier machines for its faculty. Three members of its staff are analyzing and considering two different models: Model A, a high-speed copier, and Model B, a lower-speed but less expensive copier. Model A can handle 20,000 copies a day, and costs \$6,000. Model B can handle 10,000 copies a day, but costs only \$4,000. They would like to have at least six copiers so that they can spread them throughout the faculty. They also would like to have at least one high-speed copier. Finally, the copiers need to be able to handle a capacity of at least 75,000 copies per day. The objective is to determine the mix of these two copiers which will handle all these requirements at minimum cost.

- (a) Formulate an IP model for this problem. [8 marks]
- (b) Use a graphical and algebraic approach to solve this problem. [17 marks]